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QUARTERLY REPORT
for
DARPA/ONR
HIGH TEMPERATURE SUPERCONDUCTIVITY
PERIOD ENDING: June 30, 1992

I. PROGRAM INFORMATION

Contract Number: N00014-88-C-0760

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II. PROGRAM SUMMARY

The overall goals of this program are to develop the technology of MBE growth of HTSC material, to optimize the performance of HTSC films with high transition temperatures and critical current densities, and to explore the development of electronic devices based on such material.

III. PROGRAM STATUS

Engineered samples used to study trilayer transport are being grown. The films have large defect free regions and transition temperatures in excess of 80 K. This period we demonstrated that improved control over material growth parameters leads to improved uniformity of Josephson junction critical current density.

I V ACCOMPLISHMENTS

During this period, work focused on reproducing the high current Josephson junction results reported in the previous three quarterly reports. In addition, a new proprietary flux measurement scheme, previously developed under internal Varian funding, was used to improve control of the metal beams. This technique is based on pseudo-double-beam atomic absorption spectroscopy, and is insensitive to such experimental problems as lamp intensity drift and photomultiplier gain drift. This is because light transmittance readings taken close together in time are ratioed, leaving a signal that can simply be interpreted in terms of a Beer-Lambert absorbance parameter, directly proportional to the beam density. Using this feedback during growth, more reproducible film properties were obtained. In particular, both good surface morphology and good superconductive properties are routinely obtained this way. By growing trilayer films for Josephson junctions with this improved control we have obtained tighter control over device critical current densities. Specifically, spreads of ± 40% were obtained. More work is underway to determine how accurately this can be controlled.

V PROBLEM AREAS

No significant problem areas exist.

V I CORRECTIVE ACTION

Work will continue to perfect the growth and device fabrication processes

V I I GOALS FOR NEXT PERIOD

To continue studying trilayer junctions and vertical transport in them.

VIII FISCAL STATUS

The amount currently provided on contract is $2,158,000 as of 7/3/92. The expenditures and commitments to this date are $2,022,000. These funds are sufficient to continue the work as planned.